

LA-UR-19-28571

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Title: SOURCE CHARACTERIZATION EXERCISES

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Intended for: Training for Chinese Delegation at Sandia National Laboratories, Sept. 10, 2019

Issued: 2019-08-23

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SOURCE CHARACTERIZATION EXERCISES

Jerry McAlpin

Source Characterization Exercise #1

Question #1

A source roundup will occur in the Baotou Province to recovery unwanted sources from source owners. The radioactive sources are not documented in the national source database. What information do you need to identify the sources?

Question #2

What other information would be useful to have prior to the recovery?

Question #3

Why do we need to identify the source prior to recovery?

Question #4

Provide examples of things you can use to obtain this information?

Question #5

One source is inside of a device that is used for identifying the moisture density in soil. The device has a tag attached, see below. What information can you use to characterize the source in the device?



Source Characterization Exercise #2

Question #1

A source owner has requested that you recover a source shown in the photo below. This is all the information that you have. Is it possible to characterize the source?

Question #2

If the answer is yes, how would this be accomplished?

Question #3

What are some of the issues that make characterization difficult?

Question #4

What would be a last resort if characterization information is not available?



Source Characterization Exercise #3

Question #1

The source owner has requested MEE to recover a Co60 source of unknown activity. The dose rate at 1 meter is 910 mSv/hr. What is the source activity in MBq?

Question #2

What would be the source activity at 3 meters?

Question #3


What are some reasons we may be concerned about a 3 meter dose rate?

Source Characterization Exercise #4

Question #1

Source C-707 was recovered and the documentation below was provided.

36A



GAMMATRON INC.

P.O. BOX 34042 • HOUSTON, TEXAS 77034 • AREA CODE 713/641-0391

GAMMATRON INC.

SEALED SOURCE CERTIFICATE

1. PURCHASER [REDACTED] P.O. # 66-8022

2. MANUFACTURER GAMMATRON, INC.

3. MODEL AN-HP (.625 X 1.250) SERIAL # C-707

4. ACTIVE MATERIAL Am-241 Be

MAXIMUM CONTENT 35 mCi

MINIMUM CONTENT 29 mCi

ACTUAL CONTENT BASED ON WEIGHT INPUT AND N/A
CI/GRAM AS SUPPLIED BY ORNL $\pm 1\%$

YIELD: N/A

STD N/A

GAMMATRON STD C-707=34.8 mCi

SERIAL # 77C 54533

5. THIS IS TO CERTIFY THAT THIS SOURCE MEETS THE REQUIREMENTS FOR SPECIAL FORM AS DEFINED IN DOT
TITLE 49 (173.403(Z)) AND THE REQUIREMENTS OF:

ANSI CLASSIFICATION 77C 54533 SIGNATURE BC Jones

TEXAS REGULATIONS PART 36.108 17-4SS SIGNATURE BC Jones

6. MATERIAL OF CONSTRUCTION 17-4SS

7. WIPE TEST:

INNER CAPSULE <.005 uCi

OUTER CAPSULE <.0005 uCi DATE 01/29/90

8. HELIUM TEST NEG NEG. BY BC Jones

9. PRESSURE TEST N/A N/A FINAL OUT

10. CONTAINER WIPE TEST <.0005 uCi

11. TYPE 7A SERIAL # CUSTOMER

12. SURFACE 1 mrem/hr INDEX .05 LABEL YELLOW 11

AUG-16-2006 08:05 99% P.02

What information would you select to fully characterize the source?

Question #2

Is the source special form?

Source Characterization Exercise #5

Question #1

You are on a recovery team that will be responsible for characterizing the radiography source shown in the diagram below. What information does this source provide that can be used for characterization?

Question #2

What other useful information is provided?



Source Characterization Exercise Answers #1

Answer #1

1. Physical and chemical form
2. Nuclide
3. Activity
4. Special Form

Answer #2

- Contamination results (alpha and beta)
- Dose rates (neutron and gamma)
- Manufacturer/Model of source or device
- Date of Manufacturer

Answer #3

The source nuclide, activity, and special form will allow the recovery team to determine the type of container needed for transport of the source and dose rates any shielding that may be required to meet transportation requirements.

Answer #4

- Source markings
- Device tags
- National database
- Source shipping record
- Source certificate
- Source catalog

Answer #5

Nuclide - Am241 and Cs137

Activity – 40mCi Am241 and 8.1mCi Cs137

Date of manufacture – Am241 – 12/23/83 and Cs137 – 8/17/83

Source Characterization Exercise Answers #2

Answer #1

Yes

Answer #2

- You know the source manufacturer (MRC) and isotope. With this information, you could contact the manufacturer and see if they could provide the information the needed.
- You could contact the government to determine if the source was registered.
- You could ask the source owner if they have documentation of the source (shipping paper of source certificate)
- You could see if a source catalog exist, takes source dimensions, and compare with different source models in the catalog.

Answer #3

- A source that is encapsulated into a lead shield with no source information visible.
- The source is located in a source holder that prevents you from determine the physical dimensions of the source.
- High dose rate source that prevent a close inspection of the source without the use of a hot cell.

Answer #4

Characterization through measurement

Source Characterization Exercise Answers #3

Answer #1

Formula: Activity = Dose Rate / Gamma Ray Constant

$$\frac{910 \text{ mSv/hr}}{3.7 \times 10^{-4} \text{ mSv/hr/MBq}} = 2.46 \times 10^6 \text{ MBq}$$

$$2.46 \times 10^6 \text{ MBq}$$

Answer #2

Formula: $D_3 (r_3)^2 = D_1 (r_1)^2$

$$D_3 (3\text{m})^2 = (910\text{mSv/hr}) (1)^2$$

$$D_3 = 910/9$$

$$D_3 = 101 \text{ mSv/hr}$$

Answer #3

- The dose rate to the driver of the recovery vehicle.
- The dose rate to the side of the vehicle, which could present source of radiation exposure to non-radiation workers.

Source Characterization Exercise Answers #4

Answer #1

Am²⁴¹Be, 34.8 mCi, 01/29/90

Answer #2

Yes

Source Characterization Exercise Answers #5

Answer #1

- Source Nuclide – Ir192
- Activity – 240Ci (8.9 TBq)

Answer #2

- Type of Package – Type B(U)
- Certification number for the Type B(U) package
- Type of shielding material used in the package – Depleted Uranium
- Weight of the shield